Overview

This appendix, in its draft form, provides supporting documentation for the project scoring template (Table 5-2) found in section 5.0 of the strategy document. The model is an aid to prioritize salmon habitat restoration projects. The protocol proposed for scoring specific projects represents a modification of the Indicator Value Assessment (IVA) method initially developed for addressing wetland functions (Hruby et al. 1995) and a "salmon overlay" modification of that same model (City of Everett & Pentec, 2001). It deviates substantially from these models in the type of questions asked, and the manner by which the data are ultimately used—to characterize the value of potential salmon restoration projects. The model also differs in the application of weighting factors for the final score. These weighting factors are used to normalize a potential project's score relative to: (1) the amount of habitat created from the project, (2) the geographic prioritization of the sub-watershed for overall salmon recovery where the project is proposed (see section 5.0 for sub-watershed/reach groupings), and (3) the certainty in outcome. The geographic prioritization of the subwatersheds and reaches in the Yakima watershed reflects the overall salmon recovery strategy geared towards maximizing the natural reproduction of steelhead, bull trout, chinook, and coho towards attainable and sustainable levels. Such an outcome would represent "recovery".

As described in Section 5.4, the Tier 2 project scoring method characterizes biological functionality created by potential projects through the answering of a series of yes/no questions. The maximum score for each question posed for a species is "5", if recovery of the species is of the highest priority due its endangered or threatened status. The cumulative score for all species that could benefit is tallied for each question. Questions with subcategory designations of a, b or c (e.g., 1a, 1b, or 1c) are meant to indicate that the question is applicable to a, b, *or* c. Most often, the questions are phrased in a manner reflecting that the project can be categorized as (a) protection-based, (b) restoration-based, or (c) assessment-based.

The number of species that could benefit will vary by the geographic location of the project within the watershed based upon known existing and potential use. The questions set-up by the model primarily address the biological functionality protected, restored or assessed by specific projects. However, there are elements to the scoring that reflect the objectives of the overall strategy (i.e., focus on native and naturally reproducing stocks) and are therefore in contrast to a straight-forward interpretation of biological functionality. Thus, the following premises should be considered while addressing the questions to evaluate specific projects.

- The maximum score for each question will vary by species, to reflect the overall species' role in salmon recovery in the Yakima watershed and/or their status under the ESA. The maximum scores for each species are thus as follows: steelhead = 5, bull trout = 5, chinook = 4, coho = 3. Steelhead and bull trout are given maximum scores of 5 because of their ESA listings in the Yakima basin. Chinook are not a listed species in the Yakima basin, but are perhaps the most important species to the watershed in terms of their role in the overall salmon recovery based on historic escapement, and the variety of chinook stocks present there (i.e., native, wild and hatchery); chinook are thus given a maximum score of 4. Coho salmon are given a maximum score of 3 because native coho were extirpated from the system many years ago. Ongoing efforts to reintroduce the species in the Yakima watershed are relying on hatchery introductions of out-of-basin stock origins.

- "Yes" answers are given to each question if the project is closely associated with the biological function for each species, as indicated in the question.
- In general, "yes" answers to questions that focus on protection/preservation-based projects receive maximum scores possible for the species in question. This rationale is in keeping with the overall salmon recovery strategy objectives for the Yakima watershed, and is also consistent with the goals and objectives of the Salmon Recovery Funding Board (JNRC 2001).
- In general, "yes" answers to questions focused on restoration-based projects receive slightly lower scores than the species maximum because the restoration of habitat to a functional status has greater uncertainty (and often cost) than preservation/protection-based projects. Some exceptions to this rule are seen in the scoring template, and are explained in the text below where applicable.
- In general, "yes" answers to questions that focus on assessment-based projects receive the lowest scores for each species because habitat assessment projects in this WRIA are generally considered less essential to salmon recovery at this stage in the recovery process. A significant body of information already exists for many of the systems in the WRIAs. However, there is deviation from this rule with some assessment projects because of a specific need for the information in the Yakima watershed, and the necessity of filling in the data gap before subsequent restoration or preservation-based projects can be initiated.
- Weighting factors are applied to the cumulative score for all questions and species. The cumulative score for projects in Tier1/Category-1 subwatersheds or reaches should be multiplied by 1.3; by 1.2 in Tier 1/Category 2 sub-watersheds or reaches; by 1.1 in Tier 1/Category 3 subwatersheds or reaches; and by 1.0 in Tier 1/Category 4 subwatersheds. This revised score should then be multiplied by the total area of aquatic habitat (wetted and riparian) that is created/made accessible by the project to achieve an area estimate. This area estimate is then multiplied by a "stressor" factor to normalize the project score against the certainty of the project's outcome in providing sustainable salmon habitat. Multiply the functional habitat area estimate created by 1.0 if there is 91-100% certainty of success; by 0.66 if there is 75-90% certainty of success; and by 0.33 if there is 50 to 74% certainty of success. Projects with less than a 50% chance of sustainably increasing habitat to support an increased salmon population are not supportable and should not be presented for funding to the SRFB.

Habitat Pathway: Hydrology

Question 1a: Does the project protect/preserve perennial stream or spring flows?

Assumptions: This question addresses the essential functions of feeding, refuge, spawning, migration and osmoregulation provided for salmonids by projects that could preserve existing flows in stream channels within the Yakima watershed. These functions can be affected by spring flows regardless of whether those flows are found in habitat directly used by salmonids, or upstream of salmonid habitat. Flows could be secured/preserved by such actions as land acquisition or easements along riparian corridors where ephemeral tributaries or springs ultimately flow into (or already provide) existing salmonid habitat. Projects that donate a shallow groundwater right, or prevent additional water rights from becoming established, could also yield an answer of "yes" to this question, in recognition of the groundwater/surface water connection to small streams and springs. Projects that secure water flows upstream of anadromous barriers are still viable because they recognize the hydrologic continuity of stream networks.

Protocol: Answer "yes" if the project would protect or preserve the hydrology of a freshwater stream or spring. If the project is a groundwater acquisition, the water right secured must be from a shallow aquifer hydraulically connected to a recognized stream or spring in the Yakima watershed. Scoring can be done from maps or aerial photographs, but may require field survey to verify that the water flow is significant (i.e., measurable).

Question 1b: Does the project restore perennial stream or spring flows?

Assumptions: This question addresses the same functions as question 1a, and is similar in its rationale. Because flow restoration is causal to the reestablishment of other functional elements of a salmonid stream (e.g., floodplain connectivity, in-channel habitat, etc.), flow restoration projects have maximum species scores of '5', similar to flow preservation/protection based projects. Flow restoration could occur by returning historically diverted flows back into a historic channel, or removing specific screen diversions (i.e., as appropriate).

Protocol: See question #1a protocol. Answer "yes" if the restoration of flow would be measurable after the project was complete and resulted in a quantifiable increase in fish use of habitat.

Question 1c: Does the project assess functions of freshwater spring or stream flow/velocity profile(s)?

Assumptions: This question addresses the same functions as those of questions 1a and 1b, although in practice, will primarily focus on the migration, spawning and feeding functions. In some systems, there may be potential to maximize the functionality of flows for specific life history stages and species based upon modeling such as Instream Flow Incremental Methodology (IFIM) or other tools. The assessment of stream flow could be a worthwhile endeavor as a salmon recovery project if there is information available to suggest that a system is currently artificially limited in its production potential by flow, and there is some manner by which flow limitations could be rectified. Under such a scenario, the assessment of the proper flows to support the species and life stages limited by the existing flow regime would be scientifically defensible and appropriate. Such an assessment could serve as a precursor to a subsequent project aimed at flow supplementation (e.g., by developing a storage reservoir or wetland, restoring previously diverted flows and/or securing a water right).

Protocol: Answer "yes" if the project would develop a database on flows in a basin(s) of interest to the Yakima watershed salmon recovery. Protocols for the actual flow measuring should be developed in conjunction with a project application and consultation with the Lead Entity.

<u>Question 2a: Does the project protect against future groundwater withdrawals?</u>

Assumptions: Groundwater withdrawals affect surface water discharge, although the exact location of the effects of groundwater withdrawals on surficial flows are not easily recognized. For example, in the Yakima watershed, flow regulation has altered groundwater hydrology, resulting in a reduced spring snow melt recharge. Irrigation withdrawals in the summer result in reduced base flows below the Rosa diversion dam downstream of the Columbia confluence. Groundwaters supporting summer base flows are artificially elevated in temperature due to the flip-flop flow regime, which results in groundwater recharge of the upper basin (above Rosa) during the summer months—when recharge waters are warmer. Groundwater withdrawals could further reduce baseflows, exacerbating the associated thermal impacts already limiting production in the lower basin.

Protocol: Answer "yes" if the project prevents future groundwater withdrawals. Because of the uncertainty in direct effects on surface flows, the maximum score possible is '1' for each species potentially benefited.

<u>Question 2b: Does the project restore groundwater source by permanently eliminating water right?</u>

Rationale & Assumptions: The functions of groundwater are explained in 2a (above). The maximum score for question 2b exceeds that of 2a. The direct benefit to surface flows from such an action has less uncertainty associated with it.

Protocol: See 2a.

<u>Question 3a: Does the project protect against potential shoreline erosion through riparian planting, other natural bioengineering (i.e., without armoring), or land acquisition/easement?</u>

Rationale & Assumptions: Fluvial shorelines in the Yakima watershed represent the interface with the terrestrial environment. The terrestrial interface is the principal source of organic enrichment to streams required for sustaining the detritus-based food web upon which salmonids ultimately (albeit indirectly) depend. Maintaining shoreline integrity without artificial armoring is critical for the sustenance of the food web and the integrity of floodplain function. Naturally unstable shorelines, however, can serve as a chronic source of fine sediments to streams that may ultimately affect spawning and rearing habitat conditions. Protecting erosion-prone shoreline habitats can be facilitated by a variety of means through acquisition, easement, or specialized bioengineering. This question recognizes the values of such projects, but emphasizes the need to avoid bank armoring methods used historically to reduce shoreline erosion (i.e., rip-rap, log booms, etc.).

Protocol: The boundaries between project areas should be examined during field surveys to determine the nature of shorelines. Often, distinct breaks in shoreline type define the boundaries of adjacent project areas. If these breaks are the result of shoreline armoring, bulkheading, or deep water, then the two adjacent project areas would be judged as lacking shallow-water connectivity. Projects that protect shoreline habitats without armoring will receive an answer of "yes". Such projects can be accomplished through engineering that dissipates energy away from the shoreline without compromising shoreline habitats elsewhere. Projects that compromise habitat elsewhere in the name of protecting shoreline habitat should not be scored. An example of a project that would receive a "yes" to this question would be an acquisition or easement of low gradient shoreline with a recognized off-channel/side channel network.

<u>Question 3b: Does the project restore or stabilize erosion-prone shoreline habitat without artificial armoring?</u>

Rationale & Assumptions: Riprapping or bulkheading of shorelines also interferes with normal shoreline sediment erosion and deposition processes (e.g., Canning and Shipman 1995). Thus, bulkheads or riprap at any slope that limits natural shoreline processes are scored under this question.

Protocol: This question can be answered either through site photographs of sufficient detail or through a site visit. Answer "yes" to Question 3a if the project area high-water shoreline has 10 to 50 percent riprap or vertical bulkheads. Answer "yes" to Question 3b if more than 50 percent of the shoreline is hardened. It is assumed that some assessment will be done in association with any restoration project focused on shoreline erosion, hence, there is no question addressing assessment-based projects on shoreline erosion.

Protocol: Projects that restore shoreline habitats and integrity will receive an answer of "yes". Shoreline stabilization means should not rely on immovable armoring unless part of a greater design that results in a net increase/improvement in shoreline/riparian habitat.

<u>Question 4a: Would the project protect against water temperature increases?</u>

Assumptions: When absolute temperature thresholds for salmonid survival are exceeded, the habitat is no longer usable by salmonids. However, species tolerance levels differ within the Salmonidae, and among geographic locations. Growth ceases before survival thresholds are reached (Fisher 2000). Temperature preferences are generally 1 to 3^{o}C at which maximum growth can be achieved (Timmons et al. 1991, as cited in Fisher 2000). The growth threshold for temperature is considered to be approximately 18 +/- 2 ^{o}C (64^{o}F) as a 24-hr average. Species with prolonged freshwater life cycles (e.g., coho, steelhead) are at greater risk to loss of habitat from temperature intolerance than species that spend a limited portion of their life cycle in freshwater (chum). Thus, for this question, maximum scores are given for coho, steelhead and cutthroat trout—a deviation from most other questions, where chum are given the highest score due to the species focus for salmon recovery in the Yakima watershed.

Protocol: Temperature within a project area should be determined from previous monitoring efforts to the extent practicable. Alternatively, or additionally, this data can be collected during field visits with portable field probes. Efforts should be made to characterize the temperature over the seasonal range, and such measurements should be taken in conjunction with dissolved oxygen. Measurement of acceptable temperature in a project area in the late spring or summer would suggest that this water quality factor would be unlikely to limit salmonid use in the fall through early spring, when temperatures are lower and DOs higher.

<u>Question 4b: Does the project restore habitat or flows to yield lower water temperatures over time?</u>

Assumption: See 4a. Restoration of habitat to yield lower water temperatures receives a higher score because of the recognized limitations currently caused by high water temperatures in the Yakima river (i.e. WRIA 37).

Protocol: Answer "yes" if the restoration project yields measurable reductions in the mean seasonal temperature in the project area, as compared to historical data.

<u>Question 4c: Would the project assess temperature conditions to determine production potential?</u>

Assumption: See 4a; assessment of temperature is scored lowest, as temperature limitations to salmonid production in the watershed are already largely understood.

Protocol: Answer "yes" if the project involves a temperature monitoring component coupled with an assessment of how the temperature conditions will affect growth, survival and interspecific interactions.

<u>Question 5a: Would the project protect against loss in dissolved oxygen saturation?</u>

Assumptions: This indicator addresses the health and growth efficiency of salmonids when dissolved oxygen concentrations are at their maximum for the altitude, salinity and water temperature where the project would occur. Habitat provides no function for salmonid rearing or refuge during periods when DO concentrations are depressed below thresholds of tolerance for the priority species. The thresholds for DO below which growth may be compromised is established as 6 mg/l. However, dissolved oxygen concentrations are a multi-function parameter affected by temperature, altitude and salinity—increases in all decrease the maximum dissolved concentrations at saturation (percent saturation). Because these factors will vary naturally over conditions in the Yakima watershed, absolute concentrations are less reflective of habitat quality than is an index of percent saturation. For this reason, both the absolute dissolved oxygen concentration as well as the percent saturation should be considered when evaluating how a project could affect this important water quality parameter. Maximum habitat function is provided when the majority of habitat provides dissolved oxygen concentrations at saturation, and above the absolute thresholds at all times. However, if the majority of an area does not meet temperature and/or DO criteria for salmonids (e.g., mid-day in midsummer) it can still provide suitable habitat at other times, when dissolved oxygen is not limiting. Projects that reduce thermal loadings (e.g., via shading) and/or biological oxygen demand will have a positive effect on oxygen concentrations. In-channel projects that increase mixing via aeration will also have a positive influence on this habitat parameter.

Protocol: Dissolved oxygen in a project area should be determined from previous monitoring efforts to the extent practicable. Alternatively, or additionally, this data can be collected during field visits with portable field probes. Efforts should be made to characterize the DO over the seasonal and/or tidal range, and such measurements should be taken with temperature. Measurement of acceptable temperature and DO in a project area in the late spring or summer suggests that these water quality factors would be unlikely to limit salmonid use in the fall through early spring, when temperatures are lower and DOs are higher. Answer "yes" if the project would protect against a future decrease in dissolved oxygen.

<u>Question 5b. Would the project restore dissolved oxygen saturation to naturally achievable levels?</u>

Assumption: See 5a. The restoration of dissolved oxygen is ranked higher than protection in this case, as current limitations in dissolved oxygen at multiple locations in the Yakima watershed currently preclude the use of potentially suitable habitat by salmonids.

Protocol: Answer "yes" if a measurable increase in dissolved oxygen in the project area can be shown after project implementation.

<u>Question 5c: Would the project assess dissolved oxygen to determine production potential?</u>

Assumption: In many locations within the Yakima watershed it will be necessary to gauge the suitability of water quality for supporting salmonids prior to the implementation of a specific habitat or passage restoration project. Dissolved oxygen often represents the most limiting water quality factor in marginal aquatic habitats and an assessment of the variability (seasonal and diurnal) is essential under such conditions.

Protocol: Answer "yes" if monitoring will be conducted to assess variability in dissolved oxygen concentration and its effect on carrying capacity.

<u>Question 6a: Does the project protect against future introduction of contaminant source?</u>

Assumption: This question primarily addresses the feeding and health functions, as identified in Table 5-2. Toxicants within the water column or streambed sediments could cause direct mortality, preclude the use of habitat, or cause sublethal toxicity to salmonids during periods of exposure within a project area. Such contaminants could also alter the food web upon which salmonids require for rearing. For example, outmigrant juvenile salmonids passing through a PCB- and PAH-contaminated portion of the Duwamish River Estuary were found to exhibit reduced disease resistance relative to unexposed control group fish (Arkoosh et al. 1998). In this study, the impact from such exposures to the overall salmonid population within a WRIA is assumed to be proportional to the relative percentage of the population exposed to those conditions when such thresholds are exceeded. Thus, if water column or sediment thresholds are exceeded during periods of high abundance, then the impact could be significant; if thresholds are exceeded during low abundance periods, the impact from the stressor would be less significant, but still noteworthy. It is assumed that exceedance of existing water quality toxicant standards within a project area (e.g., a TMDL listing) would equate to a potentially stressful condition for salmonids. The direct impact from contaminated sediment exposures to the overall salmonid population within a WRIA is proportional to the total area affected. Lethal concentrations of contaminants are defined by the state sediment quality standards (SQS) or cleanup screening levels (CSLs). However, the SQS and CSLs criteria are biologically-based on benthic infaunal taxa, and not directly linked to salmonids in the trophic zone. More appropriate reference thresholds may need to be addressed. A project that would prevent land use changes that might otherwise result in the introduction of a contaminant into the Yakima watershed (e.g., an acquisition) would protect against such future introductions.

Protocol: Evaluation of water column and/or sediment contaminants within a project area can be conducted by review of relevant and applicable data from the site or from a nearby location that could be construed to exhibit similar conditions based upon site history. If there were no historical record of industrial activity on or near the site, it would be unlikely that toxicant exceedances in the water column would exist. Should field reconnaissance suggest that water or sediment quality is locally impaired within the project area, then field sampling should be conducted and samples submitted to a qualified laboratory to define the extent and significance of impairment. Field observations of odd color, odor, sheen, or unusual biological indicators (e.g., dead fish, dead algae, etc.) would be indicators to the assessor that water samples should be collected and submitted for analysis from the project area. If water samples are collected, site conditions will dictate whether simple grab samples, depth-integrated, or depth-profile sampling is warranted. Standard water sampling protocols should be followed in accordance with standard methods (APHA et al. 1995). Sediment sampling protocols should be followed in accordance with local jurisdiction requirements. Thus, sampling may involve grab samples for surficial sediments or sediment coring. Site-specific protocols will be developed for each evaluation in conjunction with regulatory authorities.

<u>Question 6b: Does the project restore water quality by reducing or eliminating contaminant source?</u>

Assumptions: See 6a; the restoration of water quality impaired by contaminants to enable the use of habitat previously precluded to salmonids is highly desirable in multiple locations within the Yakima watershed. For this reason, the resolution of a recognized contaminant problem is scored slightly higher than a project that might simply protect an area from future introductions of a contaminant, as the latter should be largely prevented by existing state and federal regulations.

Protocol: Answer "yes" if a measurable improvement in sediment and/or water quality can be verified after project implementation.

<u>Question 6c: Does the project assess contaminant source fate and transport?</u>

Assumptions: The identification of source sediment and water quality contamination with toxicants may be advisable prior to the implementation of a specific habitat or passage restoration project.

Protocol: Answer "yes" if water quality or sediment quality investigations of a potential project area are usually identifiable for toxicants that could affect fish health or production.

Habitat Pathway: In-Channel Habitat

<u>Question 7a: Does the project protect or promote LWD recruitment/retention?</u>

Assumptions: Large woody debris (LWD) loading is particularly important to provide channel complexity and form pools used for rearing and refuge. It is especially important for those species that exhibit long freshwater life history phases in their life cycle. The recruitment potential of LWD varies naturally across the habitat types found in the Yakima watershed, and it has also been disrupted by flow regulation and revetments in many portions of the watershed. Projects that protect areas with functional recruitment potential are therefore particularly important.

Protocol: Areas that currently recruit LWD into the active stream channel of the Yakima watershed can be protected by acquisition projects. Project areas where LWD recruitment/retention is maintained or promoted through acquisition or other means would receive a "yes" to this question.

<u>Question 7b: Does the project restore lwd densities in area where natural retention should exist?</u>

Assumptions: Numerous reaches and subwatersheds are deficient in LWD. The importation of LWD into such areas addresses a symptom of habitat impairment, rather than the cause, but is often advisable as a transitory means to add complexity to habitat and increase rearing areas.

Protocol: Answer "yes" if the project results in a suitable increase in LWD density in the reach after project implementation.

<u>Question 7c: Does the project assess LDW loading on basis of geomorphic constraints of stream?</u>

Assumptions: The retention of wood in the channel is a function of channel width, wood size, and wood type, whereby wide channels retain proportionately less wood per unit channel length than narrower channels. For purposes of this model, LWD is defined to include the following:

- logs with length >8 m and diameter >0.6 m
- logs/trees with rootwad and/or branches, length >8 m, and diameter >0.3 m
- stumps with diameter >1 m

Ralph et al. (1991) identified "good" loading levels for Washington streams with channel widths less than 20 m in unmanaged forests at a range of 0.46 to 3.95 pieces per channel width. Values specific to the Yakima basin (as available) should be used to refine the above wood loading assessment indicators to represent a suitable recruitment of LWD in the project area.

Protocol: Wood loadings within a project area must be assessed by field surveys of the project area. A number of pieces by size class along the edge of the bankfull width line should be counted along with those visible at lower water levels. In a broader floodplain area, the number of pieces of LWD visible between is counted and divided by the area of the project area between the same boundaries.

<u>Question 8a: Does the project protect against spawning gravel scouring and/or embedding?</u>

Assumption: In some reaches of the Yakima watershed, gravel embeddedness limits the quality of otherwise suitable habitat for spawning due to excessive recruitment and/or deposition of fines. In other areas, manipulations to the shoreline or stream corridor have affected the recruitment rates of salmonid spawning-sized gravels. Flow manipulations and/or flood scours may, in some reaches or subwatersheds, also be contributing to gravel scouring. Certain property acquisitions or flow regulation projects may have the benefit of providing stability to known spawning bed locations by preventing their alteration.

Protocol: Answer “yes” if the project would occur in an area identified as a known spawning ground for any of the species of interest to the recovery strategy, and the project would help to preserve/protect the spawning areas.

<u>Question 8b: Does the project restore spawning gravels to area where natural retention should exist?</u>

Assumption: See 8a for potential impacts to spawning gravels. The restoration of spawning beds could provide direct increases to salmon production; however, the long term benefits of such projects is predicated upon addressing the source for the loss of spawning gravels initially.

Protocol: Answer “yes” if the project establishes spawning beds in a geomorphically suitable location where previously they did not exist.

<u>Question 8c: Does the project assess spawning gravels?</u>

Assumptions: The assessment of the suitability of an area for providing spawning habitat should be conducted with the consideration of other habitat restoration projects potentially implemented. However, past studies of the Yakima watershed have largely documented where spawning occurs or is impaired by an inadequate quantity or quality of gravel.

Protocol: Answer “yes” if the project involves some component of substrate assessment. Embeddedness can be determined qualitatively by visual inspection, or quantitatively by freeze-core methods.

Question 9: Does the project protect habitat access under all flows?

Assumptions: Artificial (man-made) barriers to immigration and emigration limit habitat use by salmonids for spawning and rearing, and thereby may reduce the overall carrying capacity of the aquatic environment for salmonid production. Habitat access restrictions may ultimately represent the most important element to reducing the ability of a system to support salmonids. Protecting habitat access to suitable habitat represents the first step towards ensuring that further habitat loss from displacement does not occur.

Protocol: Answer "yes" if the project proposed will not limit access and will protect existing access under all flows where access is currently facilitated.

Question 10a: Does the project restore juvenile access under high flows?

Assumption: See question #9 for role of habitat access. Restoration of access to juveniles under high flows may be a benefit, provided it does not result in stranding when flows drop. It is scored lower than 10b or 10c, as the ideal scenario provides for access under the lowest of flows.

Protocol: Answer "yes" if access is restored under ordinary high flows.

Question 10b: Does the project restore juvenile access under mean flows?

Assumptions: See question #10a. This question has maximum scores slightly lower than those identified under 10c (low flows).

Protocol: Answer "yes" if access is restored under average flows, and is not restricted by higher flows.

Question 10c: Does the project restore juvenile access under low flows?

Assumptions: See question #10a. Many areas of potential habitat are precluded from use when flows are minimal. This question receives the highest possible scoring due to the desirability of providing minimum flows that ensure habitat access to juveniles.

Protocol: Answer "yes" if access is restored under low flows, and is not restricted by higher flows.

Question 11a: Does the project restore adult access under high flows?

Assumptions: Access to habitat by adult salmon is most often restricted by depth, height and velocity barriers, as with juvenile salmonids. With the exception of depth, height and velocity barriers are less restrictive to adults than juveniles owing to their larger size. Providing access to habitat represents the first step in ensuring the potential for adult spawning and subsequent juvenile rearing.

Protocol: An assessment of whether and how passage restoration could be restored should consider available protocols for analyzing barriers to upstream migration (Powers and Orsborn 1985). Answer "yes" the design implemented restores upstream passage for adult salmonids under high flow.

Question 11b: Does the project restore adult access under mean flows?

Assumptions: See 11a; passage restoration under mean flow is scored slightly higher than under high flows because available habitat is more accessible.

Protocol: See 11a; answer "yes" if the design restores passage under mean flows.

Question 11c: Does the project restore adult access under low flows?

Assumption: See 11a. Access under low flows is the most desirable goal and is therefore scored highest.

Protocol: See 11a; answer "yes" if habitat access is provided under typical low flows in the system.

Question 12: Does the project assess habitat access/factors affecting upstream distribution?

Assumption: To answer this question, the assessor must examine the project area for the presence/absence of culverts, dikes and/or fish screens. If these are present within the project area, they pose a potential restriction to immigration/emigration of salmonids (recognizing that in some places that fish screens are warranted). Culverts should be evaluated for length, slope, diameter, jump height, pool depth, water depth in the culvert, and velocity, using the criteria established by the WDFW for adult and juvenile fish passage (Powers and Osborne 1985, Powers 1997).

Protocol: Answer "yes" if the project can determine either alternatives to immigration/emigration barriers of salmonids, or the design allow for easier passage.

Question 13a: Does the project protect floodplain connectivity (e.g., acquisition)?

Assumption: Past development and agricultural practices have confined the historic floodplain in the Yakima River, resulting in a substantial loss of productive rearing habitat. Efforts to re-establish floodplain connectivity often yield measurable increases in fish use, and provide refuge and rearing conditions for juvenile salmonids during high flows. This question addresses the existing *recognized* function of floodplain areas (vs. historic), and seeks to give credit for protecting such important habitat.

Protocol: Answer "yes" if the project, via acquisition or other means, protects existing connectivity of aquatic habitat with the floodplain.

Question 13b: Does the project restore floodplain connectivity (e.g., dike breaching)?

Assumptions: Channel armoring and roadways along many portions of the Yakima watershed currently restrict the connectivity of stream channels with their floodplains. Restoring floodplain connectivity can yield measurable benefits to water quality and fish production.

Protocol: Answer "yes" if the project restores hydrologic and biologic connections to historic floodplain habitat.

Question 13c: Does the project assess floodplain connectivity?

Assumptions: See 13a; an assessment of floodplain connectiveness to a project area may be required prior to restoration.

Protocol: Answer “yes” if the proposed project assesses floodplain connectivity.

Question 14a: Does the project protect riparian corridor?

Assumptions: Late seral stands of riparian forest are necessary to recruit LWD into the active stream channel and floodplain accessible to anadromous fish. Immature riparian forests do not provide LWD that will be retained for a long enough period of time in the channel to be considered important fish habitat elements. Riparian vegetation also provides shade and organic contributions to support the detrital base upon which salmonids ultimately depend. Riparian vegetation that includes a mix of native species will provide a greater food resource to juvenile salmonids than will a riparian border of non-native species.

Flow regulation in the Yakima watershed, particularly within WRIA 37, have resulted in the simplification of the riparian corridor. As a result, mixed-age riparian forests are not present because newly sprouted seedlings are abnormally scoured or desiccated by the flip-flop flow regulation. The long-term impact of these effects suggest that the late seral stands currently existing, once gone from natural attrition, will not be replaced at the normal rate. Such a condition, if realized, could exacerbate the high temperature conditions already identified as a limiting factor in the lower basin.

Protocol: Answer “yes” if the project protects riparian functions.

Question 14b: Does the project restore riparian corridor function?

Assumptions: The restoration of the riparian corridor is, in many cases, essential for providing a long term source of LWD to the channel, as well as providing shade over the channel and detritus to support the food web.

Protocol: Answer “yes” if the project restores riparian function.

Question 14c: Does the project assess riparian corridor function?

Assumptions: Width and composition of the riparian forest is usually assessed from a site survey of the project area, as aerial photography may not provide the accuracy to delineate the riparian composition at the widths defined by the model. The state of maturity of a riparian stand can be evaluated from recent, high-quality, aerial photographs, or from field surveys. Relatively smaller sizes of LWD can be retained in lower-energy, off-channel estuarine habitats and thus provide the same functions as larger LWD in more active channels. Mature trees considered for this purpose are those with diameter at breast height (dbh) of more than 0.3 m. Diameter at breast height should be considered from field measurements of at least six trees within the project area.

Protocol: Answer "yes" if the project involves a quantitative assessment of riparian corridor function.

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